Haupt, Dillmann, Müllenhoff and Lepsius; among mathematicians and physicists, Dirichlet, Kronecker, Erman, Dove, Kirchhoff, Kundt and Helmholtz; among chemists, Mitscherlich and Hofmann; among astronomers, Bode, Ideler, Encke; among geographers and cartographers, Ritter and Kiepert; and among biologists, Link, Braun, Lichtenstein, Ehrenberg, Müller and du Bois-Raymond. The above names represent only a selection, but these eminent members by their works have permanently influenced, and have stamped their individualities upon, the various sciences to the investigation of which they devoted their best powers and their lives. The Berlin Academy, and the very few institutions which resemble it, are the only places where men of such diverse qualifications and acquirements as Schleiermacher, Ranke, Lepsius, Dillmann, Seebeck, Kirchhoff, Helmholtz, Hofmann and Encke could be found sitting together as members and discussing the best methods for furthering the universality of knowledge. In Berlin, Vienna and St. Petersburg the past and present members of the Academies have carried out the intentions of their founders, and every branch of human knowledge has been considered worthy of recognition and encouragement at their hands.

The Academy at Paris was originally founded for the preservation of the French language, but the French savants soon found that it was necessary to establish other bodies which should represent the arts, and sciences, and archæology. Hence the Académie des Inscriptions, the Académie des Sciences, and the Académie des Beaux Arts came into being; in 1795 these Royal Academies were combined under the general title of Institut National. Thus together they represent all natural knowledge, and the various Academies really form sections of one great controlling and directing intellectual power in France. The operations of this power are so extensive that even a writer like M. Zola thinks himself entitled to enrolment among the members of one of its great sections.

When Herr Waldeyer had read his festival address he proceeded to report to the meeting what works the Academy had in hand, and to describe the progress which had been achieved in them. These included a *Corpus* of Greek inscriptions under the direction of Kirchhoff, a *Corpus* of Latin inscriptions under the direction of HH. Mommsen and Hirschfeld, the publication of the Commentaries on Aristotle, of the political correspondence of Frederick the Great, of the *Acta Berussica*, of the Latin Thesaurus by Diels, of an edition of the works of Weierstrass, of the work of Kant, of the Arabic history of Ibn Saad, of an Egyptian Dictionary, &c.; to give a list of all the works upon which the Academy is engaged would exhaust our space, and the curious reader will find them all mentioned on p. 45 ff. of the *Sitzungsberichte*.

The writing of these remarks causes many disquieting facts to cross the mind; foremost among them is that which tells us that there is no equivalent in England of the Academy of Sciences at Berlin. In its earlier years the Royal Society in a measure occupied in England the position now held by the Academy at Berlin in Germany, but such is no longer the case. The founders of the Royal Society apparently intended its members to be recruited from the ranks of scientific men of every kind, and the first seventy volumes of the *Philosophical Transactions* bear testimony to the truth of this assertion. The pages of that work were open to every scholar and man of science, provided that he had something to say and knew how to say it, and as a result the earlier volumes of the *Philosophical Transactions* are wider in their scope than the later ones.

Thus if the reader will take the trouble to turn over their pages, he will find papers on Latin, Greek, French, Irish, Phœnician, Etruscan and Runic inscriptions; accounts of pigs of lead, a tesselated pavement, a leaden coffin, Irish urns, &c.; an extract from a letter comparing the Egyptian and Chinese languages, and even a paper "On judging of the age of learned authors by style." Mr. P. H. Maty's Index of the first seventy volumes of the *Philosophical Transactions*, published in 1787, will supply many other examples of the extreme comprehensiveness of the scope and view of the Royal Society in its earlier years.

Slowly but surely the view of the Society has narrowed itself, and almost the only welcome guests are the mathematician, and physicist, and biologist; in like manner the *Philosophical Transactions* and *Proceedings* have become the home of "papers" in which letterpress and figures and algebraic signs appear in almost equal proportions. Papers on philology and archæology are extremely few, whilst those on physics and physiology greatly preponderate. Is it too late for the Royal Society to come back to the original field of its investigations? And although everything "made in Germany" is not necessarily good, it would probably gain more power and increase its influence if it imitated the excellent example afforded by the Academy of Sciences at Berlin in its efforts to further the universality of knowledge.

THE POTENCY AND PREPOTENCY OF POLLEN.

IN his book on "Cross and Self-fertilisation of Plants" (pp. 393–401), Charles Darwin called special attention to the subject of pollen-prepotency, and showed that numerous cases occur where the ovary of a given flower is more effectually pollinated by means of pollen-grains from some other flower, or from particular anthers, than by grains from its own anthers. If the two kinds of grains be present together on the stigma, the prepotent pollen is able to drive its tubes down the stigma more rapidly than the other, and so the ovules are reached first, and the egg-cells fertilised by the contents of the favoured or successful tubes—a point of great significance in crossing. Numerous examples were also given by Darwin, which indicate far-reaching effects of pollen on various parts of the flower and ripening fruit; these may be termed pollen-potency. Since Darwin's time we have learnt much more of the processes which go on in pollination and fertilisation, and, among other things, that the pollen tube of, for instance, a lily, carries down in its end, floating in its protoplasm, two active nuclei (generative nuclei) which bear in themselves the hereditable properties of the parent plant of the pollen, as well as remains of another nucleus (vegetative nucleus) of no use in fertilisation.

No fact in the domain of plant histology is better established than that fertilisation consists in the union of one of these generative nuclei with the nucleus of the egg-cell in the embryo-sac, and the researches of Strasburger, Guignard, Farmer and others have rendered the whole process of this nuclear fusion and its consequences so clear, that even minute details can be correlated with what occurs in organisms other than the flowering plants. In this connection I need only recall the demonstration by Ikeno and Irase,[1] and by Webber,[2] that the generative nucleus in the pollen tube is a spermatozoid, and in *Gingko* and some other gymnosperms is even ciliated and motile, and escapes as a true spermatozoid. This important discovery has lately been extended by Nawaschin,[3] who found that the two generative nuclei in the pollen tube of *Fritillaria* and *Lilium* are elongated, and are emptied into the embryo-sac as writhing worm-like bodies, and the same has been demonstrated by Guignard[4] for *Lilium Martagon*. The main point was also demonstrated by Miss Sargent at the last meeting of the British Association at Dover (September 1899).[5]

1 Hirase, *Bot. Cent.* 1897, p. 34.
2 Webber, *Bot. Gaz.* 1897, p. 16.
3 *Bot. Centralb.* 1899, B. 77, p. 62.
4 *Rev. Gén. de Bot.* 1899, vol. ii. p. 129.
5 *Proc. R. S.* vol. lxv. 1899, p. 163.

But Nawaschin and Guignard have further shown that, in addition to the normal fertilisation of the *egg-cell* by one of these pollen-nuclei (spermatozoid), the other spermatozoid fuses with the *upper polar nucleus* of the embryo-sac, and thus brings about a sort of secondary fertilisation—a fertilisation of the cell which, by further division, produces the endosperm. For it will be remembered that the secondary nucleus arises by the fusion of the two polar nuclei.

Divested of details, while one spermatozoid nucleus carries material from the pollen into the *egg-cell*, and so transfers the influence of the male to the egg and its resulting *embryo-plant*, the other spermatozoid carries a similar share of material from the pollen into the *polar nucleus*, and thus transfers the influence of the male to the *secondary nucleus of the embryo-sac*, and thus to the *endosperm*.

Now the endosperm is regarded as the representative of the prothallus of the higher Cryptogams, and acts as the nurse for the embryo; and the upshot of the foregoing is that not only is the embryo (and through it the future plant) affected by the male hereditary substance, which can be easily seen eventually in cross-bred plants and hybrids of all sorts, but the rudimentary prothallus generation also receives its dose of male substance, and the question arises whether the effect of this dose can be traced in any visible way.

Let us now turn to another set of events. It has been known for some time that different varieties or races of the maize or "Indian corn," although all belonging to the same species, show remarkable differences, not only in the size, shape, colour, &c., of their well-known grains, but also in the nature of their nutritious contents—*i.e.* what is usually termed the "flour" or "meal." Now, this "flour" is the endosperm, and contains the nutritious substances for the growing embryo. In the typical case its cells are crammed with starch grains, well known in domestic economy as "corn-flour." But in certain races of maize there are no (or very few and small) starch grains, but a slimy substance (dextrin?), mixed with sugar, fills the cells. Again, the outermost layer of cells bounding the endosperm—the so-called *aleurone layer*—has, not starch grains, but nitrogenous reserve stores for its principal contents, and in some races bright purple or other colouring material as well, which shines through the skin of the grain (testa and pericarp), and so gives the hue to the fruit.

The economical importance of the maize[1] has stimulated many observers to experiment in hybridising the existing races, and the principal object of this article is to show how some recently observed results in this connection have—quite unexpectedly—come to cast new lights on the phenomena above referred to, and to illustrate the potency of pollen in a way not hitherto suspected.

These researches are due to De Vries,[2] and to Correns,[3] who have found that if cross-breeding is carried on between races of maize with a starchy yellow endosperm and violet aleurone layer, and races with a sugary hyaline endosperm and colourless aleurone layer, for instance, very marked effects of the pollen can be traced *in the endosperm of the directly resulting grain*, quite apart from the effects eventually discernible in the resulting cross-bred plant to which the embryo gives rise, and which, of course, are only visible in the succeeding crop. These visible effects of the pollen are expressed only in the colour and chemical contents of the endosperm.

[1] The meal is used for Polenta, corn-flower, pop-corn, &c., and after the manner of malt in distilling spirits. The young grains are cooked. The sugary sap is used for fermented drinks, Chica, Pulque de Mahiz, &c. The straw for paper, &c. The raw grain, young shoots, &c., for fodder. Some races are of horticultural value, and so on. In 1893, 32,000,000 cwts. were imported into this country (see "Official Guide to the Museums of Economic Botany, Kew." No. 2, 1895, p. 64).

[2] *Comptes rendus*, 4/12/99, No. 23, vol. cxxix. p. 973.

[3] *Ber. d. d. Bot. Ges.* 1899, vol. xvii. p. 410.

Thus, the result of pollinating a race (A) which has a colourless aleurone layer, by a race (B) with a coloured one, may be that the ripening grain of A now obtains an endosperm with its aleurone layer the same colour as B; or if A has a starchy endosperm and B a slimy and sugary one, the endosperm of A becomes slimy and sugary, and so on.

The effect of the pollen of B, so directly expressed in the resulting endosperm of A, does not necessarily show itself in the converse case, however; and if the pollen of B alters the colour of the aleurone layer in the grain of A, the effect of the reciprocal cross may be that the pollen of A alters—not the colour of the aleurone, but—the contents of the endosperm of B, *e.g.* from starchy to sugary, and so on.

Correns points out that no visible change in the embryo, or in the size of the endosperm, or size and shape of the grain can be thus directly produced—whatever may be the more distant effects visible in the cross-breed resulting from the sowing of the grain next year.

There seem to be two possible ways of explaining these remarkable phenomena.

First, we may suppose that the spermatozoid nucleus of the pollen tube, having fused with the egg-cell, so alters the embryo that as it grows it affects the endosperm (*e.g.* by secreting some enzyme) and so alters the colour of the aleurone layer on the nature of the cell-contents; this hypothesis is supported in part by the fact that while it is easy to produce sugary endosperms in grains of races which normally develop starchy ones, the converse action is not obtained.

The second hypothesis is that we have in these phenomena the direct visible effects of the fusion of the second pollen tube nucleus (spermatozoid) with the polar nuclei (from which the endosperm results). In other words, we have here a *hybrid endosperm* as well as a *hybrid embryo*.

Both De Vries and Correns regard the latter explanation as the right one, and Correns points out that similar cases have been observed by Giltay in rye.

On the other hand, no visible results in the endosperm were obtained in peas and lilies, and the deep blue colour of the yellow seeds of species of *Leucojum* or of *Peas* crossed with the pollen of deep blue seeded races of the same in each case depends on the formation of blue proteid grains in the epidermis of the cotyledons.

That these positive results will lead to renewed investigations of other cases of nuclear fusion—*e.g.* graft-hybrids and other examples of the reactions between scion and stock—may be confidently predicted, and interesting discoveries must await us. My present object is to call attention also to this excellent example of the reciprocal advantages botanical science obtains by the co-operation of workers in two totally different fields—the results from the laboratory here throwing suggestive lights on those from the seed-bed and garden, and *vice versa*. (See, also, Address to Botanical Section of British Association, Toronto, 1897, p. 3.)

H. MARSHALL WARD.

ATMOSPHERIC ELECTRICITY AND DISEASE.

LAST summer I had the honour of making the acquaintance of Dr. Schliep, of Baden-Baden. He is well known to English medical specialists. He urged me to design a recording electrometer, such as would enable medical men to study atmospheric electricity. I found that he himself had made daily observations for twenty years, using a gold-leaf electroscope, which enabled him to say whether the air had strong or weak, positive or negative, electric potential, at the end of a